

Key

Remedial Action Plan for Hamilton Harbour



Goals, Problems and Options

Summary Document, March 1988

URBAN MUNICIPAL

OCT 19 1988

GOVERNMENT DOCUMENTS

A

SUMMARY REPORT
of the
GOALS, PROBLEMS AND OPTIONS
for the
HAMILTON HARBOUR
REMEDIAL ACTION PLAN

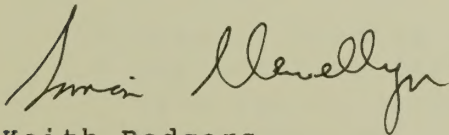
Keith Rodgers (Coordinator)	-	Environment Canada
Tom Murphy	-	Environment Canada
John Vogt	-	Environment Ontario
Duncan Boyd	-	Environment Ontario
Vic Cairns	-	Fisheries and Oceans Canada
Craig Selby	-	Ministry of Natural Resources
Len Simser	-	Royal Botanical Gardens
Howard Lang	-	Ministry of Agriculture and Food
Scott Painter (Editing)	-	Environment Canada
Janet Huehn (Liaison)	-	Environment Canada

March, 1988

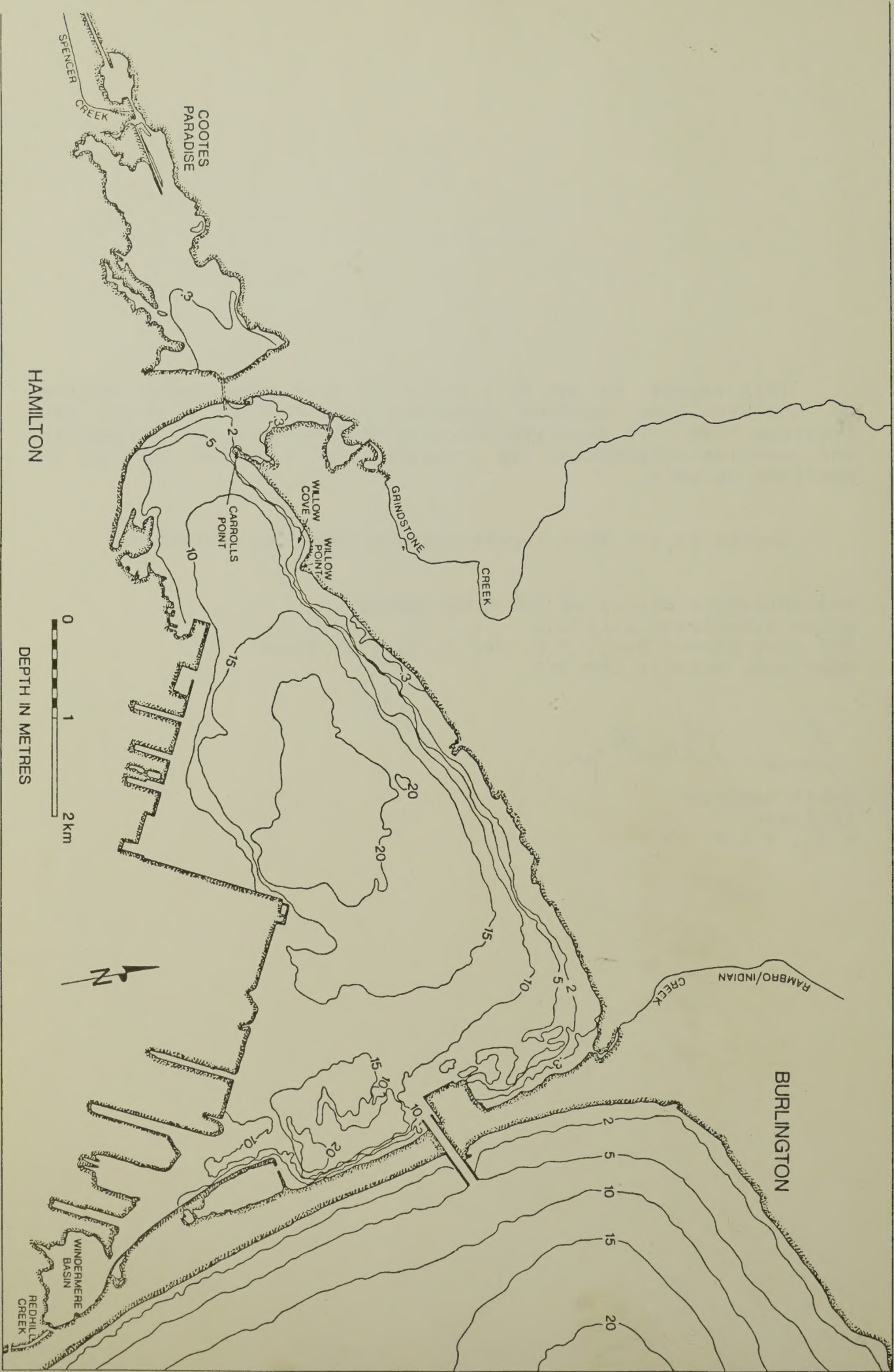
This report is one in a series of discussion papers written by the Hamilton Harbour Remedial Action Plan Writing Team (writing team), in consultation with stakeholders and the public, and contains information to consider on remedial options for Hamilton Harbour.

Copies of the full report are available by contacting:

The Ontario Ministry of the Environment
Ellen Fairclough Building
119 King Street West, P.O. Box 2112, 12th Floor
Hamilton, Ontario L8N 3Z9



for Keith Rodgers
Chairman
H.H., R.A.P



INTRODUCTION

The International Joint Commission (IJC), has identified 42 Areas of Concern, 17 of which are located in Ontario. In 1986, the governments of Canada and Ontario committed themselves to developing Remedial Action Plans (RAPs) for these areas. The Hamilton Harbour RAP writing team was appointed and assigned the task of preparing a RAP in consultation with the public.

The RAP writing team is composed of members from the following agencies:

- * Environment Canada (DOE)
- * Environment Ontario (MOE)
- * The Department of Fisheries and Oceans (DFO)
- * The Ministry of Natural Resources (MNR)
- * The Ministry of Agriculture and Food (MAF)
- * The Royal Botanical Gardens (RBG)

Hamilton Harbour was recognized as a polluted body of water long before 1986. Since 1850 a significant loss of wildlife habitat has occurred around the harbour as a result of shoreline filling. By the 1960s, as surrounding communities grew, increased municipal and industrial discharges caused serious pollution problems in the harbour.

In the 1970s, measures to control the pollution were undertaken. The results of these measures have become evident in a number of ways:

- * several species of birds have returned to the harbour;
- * reproductive failures and deformities no longer occur in fish eating birds;
- * the number and diversity of fish species is increasing;
- * improvements have been documented in the number and type of worms inhabiting the sediment at the bottom of the harbour;
- * 42 species of fish are now successfully reproducing in the harbour, and;
- * seven sport fish species in the harbour can be eaten with no restrictions.

These improvements are the result of the approximately \$300 million that has been spent by industries and all levels of government on pollution abatement programs.

While improvements have been made in water quality, a number of remaining problems still exist:

- * wildlife habitat has been lost;
- * incidents of lead contamination and botulism in waterfowl have occurred;
- * birds which live in colonies may lose their habitat due to development;
- * ammonia concentrations are high;
- * for two months in the summer, oxygen levels are low in the deeper waters;
- * sediments in the harbour may represent a source of contaminants;
- * there are eating restrictions for large specimens of five fish species in the harbour, and;
- * poor water clarity limits fish habitat, aquatic plant growth and swimming.

The participation of the public is essential in bringing together the economic, environmental and social concerns of the communities surrounding the harbour. To meet this need, Environment Canada and Environment Ontario invited organizations, industry, and local government representatives who have an interest in the harbour to participate in a stakeholders group. During 1986 and 1987, the stakeholders identified their principles and goals necessary to restore beneficial uses to the harbour. Actions to solve the remaining water quality problems in the harbour depend on the kinds of uses which the stakeholders have identified.

The stakeholders identified specific goals based on the principle of an ecosystem approach and the philosophy of zero discharge of persistent toxic substances and secondary principles of human health, public acceptance and support, and aesthetics. The stakeholders' goals are related to recreational boating, water sports, shipping and navigation, industrial uses for water intakes and discharges, a waste water receiving body, fisheries, wildlife and habitat appreciation, swimming and use as an educational resource. The stakeholders' principles and goals are stated in the Stakeholders Interim Report of 1986 and are appended to this document.

The following section identifies the current conditions which must be overcome in order to achieve the stakeholders' goals.

LIMITATIONS TO ACHIEVING STAKEHOLDER GOALS

All the stakeholders' goals can be achieved by addressing their three key goals for fish, wildlife and swimming. Water quality, habitat loss and limited access are common limitations to achieving these goals. Many of the limitations are interrelated.

1. Ammonia Concentration

The levels of ammonia in the spring, exceed the provincial Water Quality Objective for the protection of aquatic life. The levels are so high they are toxic to fish. Bacteria convert the ammonia to nitrate during the summer which eliminates the problem of toxicity. However, 40% of the oxygen is used up adding to the problem of low oxygen.

2. Habitat for Fish

In addition to clean, well oxygenated water, fish require an abundance of plants. However, plants grow in only half of the nearshore areas suitable for sport fish habitat. Also, warm water fish are dominated by less desirable species (such as carp and white perch) which destroy the existing plant life, and compete for food and habitat.

Pike have specific needs for reproductive habitat. There are insufficient spawning and nursery areas for pike.

3. Water Clarity and Suspended Solids

Continuous exposure to concentrations of suspended solids above 25 milligrams per litre is harmful to fish. Shallow water areas of the harbour have concentrations of suspended solids which exceed this level.

Water clarity decreases with greater concentrations of algae and suspended solids. Algae is responsible for 10 to 30% of the total water clarity impairment in Hamilton Harbour and for less than 10% of the impairment in Cootes Paradise. The remaining problem is due to suspended solids and silt.

Nearshore water clarity is reduced further by wave action, resulting in the resuspension of silt, by the behaviour of carp, and from stream inputs of silt. Poor water clarity limits aquatic plants to 64 hectares.

4. Oxygen Concentrations

Oxygen concentration in deep water is insufficient to support fish during two months in the summer. Therefore, cold water fish must leave the harbour during these months. Warm

water fish such as bass and pike are not limited to the deep water. However, maintaining oxygen levels is important for supporting bottom fauna which are a source of food for the fish.

Improved oxygen levels will also inhibit the release of toxic metals and phosphorus back into the water from the sediments and enhance decay of organic material.

5. Contaminants

MOE and MNR annually publish a Guide to Eating Sport Fish in Ontario. There are fish consumption restrictions on large specimens of five out of 12 sport fish species found in Hamilton Harbour. Because these species are not permanent residents of the harbour, the contaminant content in the fish may not have come from Hamilton Harbour alone.

6. Wildlife Habitat

A. Loss of Wetlands

Wetlands contribute to the overall health of the ecosystem and provide the habitat necessary for a balanced and diverse wildlife population. The Canadian Wildlife Service ranks the west end of Lake Ontario, including Hamilton Harbour, as the second most important waterfowl staging area in Lake Ontario. It is also the fourth most important area on the lower Great Lakes. However, Hamilton Harbour has lost 80% of its original wetlands. Increasing the amount of wetlands in Hamilton Harbour is important for local wildlife and general bird populations.

B. Water Bird Colonies

Nesting habitat for water birds which live in colonies such as terns and cormorants now exists in the east end of the harbour in an area built and used for disposal of dredged sediments. However, the site will be at capacity by the year 2000, thus threatening the future of the existing waterbird colony.

C. Clean Wildlife Habitat

Large numbers of migratory waterfowl stay over winter in Windermere Basin because of the warm water and abundance of food. However, contaminants in the sediment could be picked up by the birds through the food chain. Recent incidents of bird deaths have been attributed to lead contamination and botulism. Clean up of this shallow basin is important for a healthy waterfowl population.

7. Limitations To Swimming

There are four limitations to achieving the goal of swimming in Hamilton Harbour:

- * data on bacterial levels indicate there may be a health risk to swimmers in the nearshore water;
- * water in the nearshore is too cloudy to permit swimming;
- * there is limited safe access to appropriate swimming areas in the harbour, and;
- * a by-law makes it illegal to swim in the harbour.

REMEDIAL OPTIONS TO RESTORE USES

In order to restore beneficial uses of the harbour, options were considered that would reduce or eliminate the limiting factors for achieving the stakeholders' goals. Some of the options listed are experimental in nature.

1. Ammonia Concentrations

In, 1987 ammonia loadings to the harbour were 7500 kilograms per day. In order to eliminate the toxic concentrations of ammonia and improve oxygen levels, a 50% reduction in ammonia discharges is needed. The Hamilton and Burlington sewage treatment plants (STP) are the largest sources of ammonia. Reductions of 50% would require capital costs of \$3 million to Hamilton and of \$6 million to Burlington and would require annual operating costs of \$250,000.

Actions already underway by Stelco and Dofasco will reduce their discharges of ammonia from 870 to 170 kilograms per day. This will cost the companies \$13 million.

Retention and treatment of combined sewer overflows (CSO's) could further reduce ammonia loadings for the CSOs from 200 to 20 kilograms per day. One retention basin has been constructed which addresses 25% of the problem. There are 25 other CSOs which still have to be controlled. The Regional Municipality of Hamilton-Wentworth plans to control all its combined sewer overflows over the next 20 to 40 years at a cost of \$60 million. A computerized system to optimize the storage capacity of the present sewer system could reduce the number and size of any retention basins needed. A pilot project is underway to assess how well the system will work.

2. Habitats for Fish

Creating habitat is as important to the fishery goal as improving water quality. The following options are based on increasing the number of desirable sport fish such as bass and pike. This will require creating suitable reproduction and nursery habitats. Creating reproduction habitat for bass requires improving the existing adult habitat. Pike require separate and different habitat for spawning, nursery and adult use.

Construction of all the habitat projects listed below could result in a total of approximately 120 hectares of sport fish habitat. Construction costs could be \$3 million with annual maintenance costs of \$100,000. These options have been suggested but detailed plans and feasibility studies have not been undertaken.

Restoration of suitable habitats for bass and pike to reproduce and develop could be attempted in five areas. They are discussed in order of importance.

Grindstone Creek Above Valley Inn Road

The available area totals 17 hectares. Pike currently reproduce in 3.7 hectares, and use a nursery area of one hectare. Increasing the spawning area by one hectare and providing a nursery habitat of an additional 1.3 hectares could produce an additional 1500 to 3000 fingerlings. Increasing the habitat in this area is estimated to cost \$100,000, with an annual maintenance cost of \$10,000.

Cootes Paradise

Pike reproduction and nursery habitats do not exist in Cootes Paradise. The bass habitat is limited due to the lack of hiding places and aquatic plants. A bermed cell specifically for fish reproduction is possible between Bulls Point and Princess Point. Studies done at other areas indicate that bass reproduction could occur at the rate of 30 kilograms of bass per hectare, per year.

Incorporating pike reproduction and nursery habitats in the design would require water level control and a fish ladder. A cell providing 100 hectares of habitat is estimated to cost \$1 million, with annual maintenance costs of \$50,000.

Southwest Corner of the Harbour

The southwest shore between the Desjardins Canal and the former Lax property is an important sport fish habitat. Currently four hectares of adult pike and bass habitat exist

along this shore. Increasing this area to 35 hectares would be possible by land filling to shape the shore into embayments. These embayments could also make good public fishing and swimming sites. Construction costs are estimated to be \$1.7 million, with annual maintenance costs of \$30,000.

Burlington North Shore

The north shore provides the largest potential for adult habitat in the harbour. The lack of hiding places along the north shore is limiting fish populations. Placing 12 sets of artificial reefs could create 12 hectares of adult habitat. Capital costs are estimated to be \$10,000 for each reef with annual maintenance costs of \$5,000 for each reef. The target for fish production is 600 kilograms per year.

Grindstone Creek Delta

Building islands in the Grindstone Creek Delta will reduce turbidity and encourage plant growth. The area would provide 22 hectares for bass and pike reproduction habitat. It is estimated it could produce up to 1100 kilograms of sport fish per year. The construction costs are estimated to be \$200,000 with an annual maintenance cost of \$10,000.

3. Water Clarity and Suspended Solids Improvements

Improvements in water clarity require control of phosphorus loadings in order to limit algal growth, reduce silt input and minimize resuspension of bottom sediments.

A pilot project for improving phosphorus removal is underway at the Hamilton STP. If successful approximately 50% of the discharged phosphorus could be removed at little or no additional capital cost. The process could be applied to the Burlington STP as well. Water clarity in the harbour would improve by 10%.

Improved agricultural practices which would reduce phosphorus and suspended solids by 50% could lead to a 20% improvement in water clarity. Using conservation tillage practices and improving erosion control could achieve the water quality improvements in time. Since 1980 the Ministry of Agriculture and Food has had a program to help farmers adopt conservation practices.

Water clarity could be improved by an average of 40 centimeters, increasing available fish habitat to 92 hectares as a result of these above improvements. If the proposed habitat construction projects are carried out, these improvements to water clarity could provide approximately 120 hectares of habitat.

Use of sand filters and dual point chemical treatment to control phosphorus will improve water clarity a further 60 centimeters, as well as increasing oxygen levels. The habitat improvements, such as artificial reefs and renewed plant growth, will add to nearshore water clarity. In Cootes Paradise, habitat construction could reduce solids concentrations to 25 milligrams per litre or less.

4. Oxygen Concentrations

Oxygen levels in the deep water are reduced by bacterial action that converts ammonia to nitrate, and by decaying algae.

Reductions in ammonia loadings could ensure that minimum deep water oxygen concentrations do not fall below 1.5 milligrams per litre. The phosphorus and silt discharge controls, which will improve water clarity, will also increase the minimum deep water oxygen concentration by another 1.5 milligrams per litre.

If the improved chemical treatment does not adequately control phosphorus, sand filters with dual point chemical treatments at the Hamilton and Burlington STPs could be used. The filters would also improve offshore water clarity by an additional 60 centimeters. Sand filters and dual point chemical treatments would cost \$57 million, with an annual maintenance cost of \$170,000.

Several options for direct treatment of the harbour such as oxygen injection and harbour water circulation have been identified. These could be used to increase oxygen levels until other remedial measures are effective.

5. Contaminants

The Municipal-Industrial Strategy for Abatement (MISA) program will regulate persistent toxic substances from municipal and industrial sources, based on best available technology (BAT).

Environment Canada and Environment Ontario are currently developing biologically-based sediment quality guidelines. The new guidelines should be in draft form by late 1988, and will update the existing guidelines for open water disposal of dredged material. The purpose of the new guidelines is to help identify sediments which have an unacceptable level of contamination and which may require remedial action. These guidelines will be used to evaluate sediments throughout the Great Lakes.

The RAP writing team is presently unable to determine, to what degree fish tumours and the tissue burden of contaminants in fish are related to contaminated sediments.

The following course of action is recommended:

- a) map areas of highest concentration and toxicity;
- b) determine if biological effects are due to contaminants in the sediments; and
- c) assess alternatives to dredging and confined disposal such as chemical treatment or capping and sealing of the sediments.

6. Wildlife Habitat

A. Wetlands

Cootes Paradise and the Grindstone Creek delta provide some of the best opportunities for achieving wetland restoration. This is due to the degree of protection from human disturbance and urban development, and the existence of relatively uncontaminated sediments. Access and amenities for wildlife appreciation already exist.

A method of marsh rehabilitation that has been used successfully elsewhere, involves the construction of dikes to close off suitable areas. The Royal Botanical Gardens has sought expertise from Ducks Unlimited to implement such a scheme.

Through the use of pumps, the water level can be manipulated inside the diked areas, regardless of the lake levels. The dikes will also keep out carp and reduce wind resuspension of bottom sediments. The dikes would cost an estimated \$750,000.

A mud flat area for shore birds could be created by placing a berm across the outlet of the West Pond of Cootes Paradise, if the Dundas STP effluent is diverted. Flooding during the summer would limit plants from encroaching on the site, but spring and fall drawdowns through pumping will expose the mud flats, and allow shorebirds to use the area. Exposing the mud flats is especially important during spring migration when the shorebird habitat is restricted.

B. Colonial Waterbirds

A new site for water birds which nest in colonies could be developed in the harbour to accommodate the species currently nesting at the east end dredged spoils area. It is desirable to maintain existing populations, with the exception of the Ring-billed Gulls, which need to be limited to 5000 pairs. Ring-billed Gulls attract other colonial waterbirds such as Caspian Terns, but a one hectare area should be sufficient to accommodate several bird species, while controlling the number of Ring-billed Gulls. This area could be created by enlarging the two Hydro Islands to 0.5 hectares each. How much this option will cost has not been determined.

C. Clean Habitat for Wildlife

Waterbirds will continue to utilize Windermere Basin because it is shallow, the water is ice free in the winter and there is an abundance of food. The dredging project for Windermere Basin is planned to start in 1988 which will remove the contaminated sediments. The project will cost \$4.5 million.

7. Swimming

If swimming is desired there are three areas which could be considered for building swimming facilities:

- * the former Lax property in the west end of the harbour;
- * the waterfront area adjoining LaSalle Park on the north shore, and;
- * the northeast portion of the harbour adjacent to the Canada Centre for Inland Waters in Burlington.

It is evident that the goal of swimming in the harbour can only be reached if:

- * water clarity is improved by reducing solid and phosphorus loadings from all sources;
- * any bacteriological problem in shoreline areas is resolved;
- * the legal constraints are removed, and;
- * access to swimming areas is provided.

In order to improve water clarity and maintain safe bacterial levels, the CSOs near swimming areas must be controlled. Good solids controls must be maintained at the sewage treatment plants in order to obtain efficient disinfection.

CURRENT RESEARCH

The Remedial Action Plan should be viewed as an evolving process. As the goals, problems and options for the harbour are discussed among the scientists, stakeholders and the public they become clearer and more focused. The completed RAP will contain an implementation schedule for restoring beneficial uses.

Some options can be implemented now. However, there are a number of problems which are not fully understood and for which solutions have not been found. The RAP writing team and other scientists from the participating agencies are continuing to

investigate these problems and their influence on water quality. In particular, remedial measures for contaminated sediments cannot be selected until further studies are completed. In addition some measures are experimental, and should be tested on a pilot scale before they can be considered as viable options for Hamilton Harbour.

Projects planned for 1988 include:

- A. In order to study habitat preferences and the ability of pike to survive, last year's successful program to introduce pike into the harbour will be expanded in 1988. The results of this study will more clearly define how habitat can be improved.
- B. Several studies are planned to increase the understanding of the effect of contaminants in the sediments on plant and animal life. Studies will look at the extent of contaminants in the sediments, the release of contaminants to the water, the effect on plant and animal life and bioaccumulation in the food chain.
- C. Studies of land uses, mapping erosion potential and monitoring creeks will provide information on the sources of silt and suspended solids to the harbour. The results will help to select appropriate actions to reduce erosion and improve water clarity.
- D. Additional measurements of flows within the harbour and between the harbour and Lake Ontario will be used to more accurately predict what further loading reductions are required.
- E. Pilot studies to improve existing processes for removing phosphorus and ammonia from municipal discharges are underway.
- F. More detailed water quality surveys are being undertaken so that a means for measuring the success of remedial actions can be established.

Discussion and written comments on the goals, problems and options is encouraged. These discussions and the results of current research will be reflected in the next discussion paper where the preferred options will be identified. Opportunities for discussion are planned. Please send written comments to:

The Ontario Ministry of the Environment
Ellen Fairclough Building
119 King Street West, P.O. Box 2112, 12th Floor
Hamilton, Ontario L8N 3Z9

APPENDIX

The following principles and goals are quoted from the Stakeholders Interim Report of 1986, and subsequent discussions at stakeholder meetings.

STAKEHOLDERS' TWO PRIMARY PRINCIPLES

1. The Ecosystem Principle

Economic, social and environmental goals must be viewed in an integrated manner, that not one of the three can or should take precedence over another.

2. The Philosophy of Zero Discharge

The philosophy be adopted whereas control of inputs of persistent toxic substances shall be zero discharge, and therefore, the discharge of any or all persistent substances be virtually eliminated.

STAKEHOLDERS' THREE SECONDARY PRINCIPLES

1. Human Health

Water quality in Hamilton Harbour's drainage basin be improved to ensure continued human health and well being; and that through an ecosystem approach, the water quality be improved to support a multiplicity of uses, both in the short and the long term.

2. Public Acceptance and Support

Public access is an important factor in achieving public awareness and support for Hamilton Harbour remedial actions; and

Public support for these actions will result in water quality improvements leading to community benefits; and

Increased access is a key to achieving remedial actions and should become part of the overall solution whilst recognizing that access is a local authority concern.

3. Aesthetics

Aesthetic improvements on a harbour-wide basis, provide the public with a basis for genuine belief that water quality can be improved.

AMENDMENT

REMEDIAL ACTION PLAN FOR HAMILTON HARBOUR

"GOALS, PROBLEMS AND OPTIONS
SUMMARY DOCUMENT, MARCH 1988

APPENDIX - Page 1

STAKEHOLDERS' FIVE SECONDARY PRINCIPLES

Substitute 3. "Aesthetics" with the following:

Recognizing the importance of ensuring broadened opportunities for the general public to enjoy the benefits of an improved harbour resource on a continuing basis:

3. Access (Physical and Visual)

It is the position of the Stakeholders' Group that significant improvement is required in terms both of quantity and quality, to the opportunities and locations for physical and visual access to the Hamilton Harbour.

4. Land Use

That the issue of the character and appropriateness of the land uses situated adjacent and in close proximity to the Harbour is of major consequence and must be addressed, if a successful and comprehensive plan for the remediation of the Hamilton Harbour is to be achieved.

5. Aesthetics

Aesthetics improvements on a harbour-wide basis, provide the public with a basis for genuine belief that water quality can be improved.

Amended at the Hamilton Stakeholders' Group meeting dated
April 27, 1988

DELETE

THIS

LEAF

STAKEHOLDERS' USE GOALS

The stakeholders developed a series of specific goals for current and continuing uses:

1. Recreational Boating: Immediate action should be taken to improve water quality for recreational boating, on a continuing basis for the total harbour.

2. Water Sports: On a specific basis water quality should be improved to permit increased use of the harbour for water sports, on a continuing basis.

3. Shipping and Navigation: Shipping and navigation uses should continue and be contained in certain areas of the harbour, with a view to reducing negative water quality impacts.

4. Industrial Uses for Water Intake and Discharge: The quality of the harbour water should be improved to permit continuation of industrial uses. Industrial water uses should continue in certain area of the harbour and effluent discharges should meet Ministry of Environment guidelines.

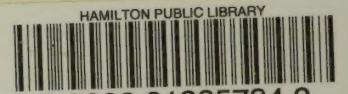
5. Wastewater Receiving Body: The harbour's current status as a waste water receiving body be changed so that it becomes a recipient of acceptable effluent in specific areas. A loadings-target approach be established for point and non-point pollutant sources and linked to all other uses to ensure effluent quality does not impede other uses.

6. Fisheries: Water quality and fish habitat should be improved to permit an edible, naturally reproducing fishery for warm water species. Water and habitat conditions in Hamilton Harbour should not limit natural reproduction and the edibility of cold water species.

7. Wildlife and Habitat Appreciation: Water quality improvements should be made to permit an enhanced wildlife habitat on a harbour-wide basis.

8. Swimming: a) Providing water quality meets appropriate health standards in the west end to support swimming as a use water quality should be enhanced to permit swimming in the short term; b) In the event that fecal coliform counts exceed water quality objectives for human contact consideration should be given to using disinfectants and suitable membrane barriers to permit swimming in the short term, and; c) Hamilton Harbour water quality should be improved so that it provides for swimming in certain areas of the harbour over the long term and has no impact on water quality for swimming in nearshore Lake Ontario

9. An Educational Resource: Educational programs be developed to change public perception of the current condition of the harbour in support of efforts made by stakeholders towards remedial actions.



Remedial Action Plan Plan d'Assainissement

Canada Ontario 

Canada-Ontario Agreement Respecting Great Lakes Water Quality
L'Accord Canada-Ontario relatif à la qualité de l'eau dans les Grand Lacs